IN THE MATTER

of the US Patent Application No.10/564/40

Impeller drive for a water jet propulsion unit

Paul Mark Paterson et al

AFFIDAVIT OF Mark Appleton HILDESLEY

Sworn: 14th May 2008

P.L. Berry & Associates
Patent Attorneys
Christchurch

1st Floor, A.E.Q. Building
61 Cambridge Terrace
Christchurch 8013
New Zealand

Contact person: Elspeth Buchanan

Email: office@plberry.co.nz

Ph: +64 3 366 2761
Fax: +64 3 379 5744
P.O. Box 1250
Christchurch 8140
New Zealand

AFFIDAVIT OF Mark Appleton HILDESLEY

I, Mark Appleton HILDESLEY, a US Citizen residing in Auckland, New Zealand, swear as follows: -

1. I am the Managing Director of Materials Optimization, Ltd., a New Zealand company which is a consulting company that works in industrial processes and design of marine craft and other industrial items, including professional experience with the items described in this invention.

2. I have a Bachelors degree in Materials Engineering from Stevens Institute of Technology in Hoboken, New Jersey, USA (1998) and a current U.S. Professional Engineering License (P.E.) in Naval Architecture and Marine Engineering (State of Maine #10459) obtained in Maine in 2003. I qualified as a Certified Composites Technician in 1999. I am a member of the Society of Naval Architects and Marine Engineers (since 2001), a board Member of the Composites Association of New Zealand and a Board Member of the Institute of Biomedical Technologies at Auckland University of Technology due to industrial consulting experience in mechanisms and applications. Materials Optimization is a Listed Research Provider registered with the New Zealand Government. I am a listed co-inventor for a marine technology patent (US Patent 6,016,759).

3. I have worked in the marine and consulting industries full time since 1998 in the U.S.A. and New Zealand and have been an active marine user and participant for most of my life and all of my adult life. I worked for North End Composites that produced industrial composite tooling for jet boat powered hulls (Hamilton Jets used by the Hinckley Company in Southwest Harbor, Maine, U.S.A) as well as jet ducting composite parts for Kamewa Jet units for a US based ferry application. I subsequently worked for the Hinckley Company as an engineer on their production powerboats that utilized Hamilton jets of various sizes and engines of different sizes to power the jets. A regular part of my job was to drive the boats and support their technical needs in all aspects of installation, construction of mounts and materials and operation. I was instructed in their use and maintenance during a period of technical sales support. I helped in the design and construction of a New Zealand sprint jet boat utilizing a two stage Scott Jet drive unit and have driven various other models of jet craft since leaving the Hinckley Company in 2003. Currently I am consulting to a pump development company where I am part of a design team concerned with mechanisms and chamber design.

4. I have studied the Examiner's Office Action Summary report related to communication filed on 23 January, 2008 (Application No. 10/564,140) and note that the Examiner rejects a number of claims based on the basis of 3 patents: Brown (US 5,480,330), Blanchard(US 6,273,768) and Austin(US 3,601,989) specifically on the basis that the applicant's claim is "obvious at the time to a person having ordinary skill in the art".

5. IN the comments given below, I have reviewed the Examiner's arguments in detail. The basis of my review is that for "one skilled in the art", if the prior art presented is to be significant to reject the claims, it must have an intended similar objective or method of operation to that of the application. If the intended objective differs, then there is an inventive step that has taken place, even though certain features of the application may appear obvious to initial review. In my view, the inventiveness lies in the differences of geometry in place in the applicant's invention and the effect that this altered geometry has on the flow of fluid through the applicant device(s).

6. AS one skilled in the art, the writer finds that the devices described in Austin, Blanchard and Brown all describe mechanical geometry designed to increase pressure and the velocity of flow out of the channel of the pumps, upon exiting the device. This type of design was known at the time of invention and if a designer was asked if these three patents described high pressure - low mass of water passing through these designs, they would say yes. If those same practitioners were asked if the same devices could be run to produce a low pressure - high mass output, the answer would be no. There is no range in which the choice of blade number or rotational speed of either first or second impellor could produce a low pressure - high mass output result in the Austin, Blanchard and Brown descriptions. The design choice referred to by the Examiner in page 4 paragraph 2 of the Detailed Action Response would require such a design choice to have the outcome that the pump could produce the low pressure-high mass output described by the applicant. The nozzle configurations described by the prior art teachings will not allow this outcome from impellor selections or operating speeds that would be common practice at that time, or since.

7. Common Practice in July 2004 would not have been to create a housing where the output taper was not decreasing the final diameter of the output flow. If the Part #70 in Blanchard were just an extension tube, with no decrease or increase in diameter, it would still not match the effect of the applicant's design as the housing is already decreasing in diameter in Blanchard, before the attachment of the outlet nozzle (Fig. 2 feature 22 right hand flow exit end).

8. THE *outer* diameter after the second impellor, in the applicants' design, is not changing the direction of the *outer radius flow* in a *radial* direction. This feature of the applicant design is **unintuitive** compared to all the described features in Austin, Brown and Blanchard. The distinction of intended purpose is clearly that the features of the present invention are described to allow high masses of water with little pressure change to be permitted through the housing design. The thrust is generated by mass movement, not induced pressure differences through direction change, which was not the intent of the nozzle designs described by Austin, Brown and Blanchard.

9. IN item 8 page 5 paragraph 4 of the Detailed Action Response the Examiner argues that relative terms do not carry patentable weight, since no specific pressure or mass range is indicated by these terms, but the two styles of design (high mass low pressure and low mass high pressure) would

produce different results for the same inputs of blade number, radius and rotation speeds, because of the difference of geometry in the two ideas.

10. IN the writer's opinion, it is not reasonable to interpret that in the absence of specific water pressure and mass limitations the devices described in the prior art can function at any given water pressure. It would be clear to a person skilled in the art that the friction and cavitation buildup from backpressure on the mechanisms will eventually limit the output of the jet to the input power of the engine or engines producing the rotation. If a specific water mass is chosen as a throughput value for design comparison purposes, the applicant's design would have a very different pressure difference than the prior art. For a specific set of mass and configuration, the intended purpose of the nozzle geometry will only produce useful quantities of thrust over a certain range of RPM. Moving this same mass through the applicant nozzle design with the same RPM and diameter and speed of impellors would result in a different thrust value, and the range of speeds and pressures that typify the applicant design can best be summarized as low pressure-high mass.

11. THE purpose of the prior art nozzle and cavity geometries are to increase pressure on the mass of water that needs to be moved through the jet in order to create a useful pressure difference. The purpose of the applicant cavity and nozzle geometry is to allow the largest mass of water possible through for a given speed of impellors to maximize the thrust by mass acceleration and transfer. A decrease in outer diameter of the nozzle will decrease the ability of the applicant invention to transfer mass through the jet and thus the prior art concept would reduce the performance. This idea could have been understood at the time of invention, by someone practiced in the art, but it was not an obvious design choice that would be made in common practice. This novel geometry description has meaning once the relative differences of the two design intentions both exist and are clear.

12. ONE point that will be obvious to a person skilled in the art is that the shape and size of the end of the nozzle on the prior art designs all decrease in their radial size (taper) to concentrate the flow of the liquid through them and increase the pressure change in the nozzle. The shape, size, number and position of the blades in the impellors also will be designed and selected for the same intended pressure increase. This is the common practice for all these nozzle designs.

13. THE goal of the applicant design is to increase mass throughput and not to increase the pressure in the liquid. The plug part #18 in the applicant design is centered at the point where the prior art geometry would be directing the flow. The characteristic flow path difference between the two concepts is that the outer edge of the flow in the prior art design is pushed into the center of the nozzle to increase pressure and the inner edge of the flow in the applicant's design is pushed out towards the outer edge to keep mass flow and throughput at a maximum.

14. Applicant design increases mass flow while prior art design increases pressure. The plug feature #18 in the applicant's description is intended to reduce or prevent air re-entry at the back of the outlet (part #3) and thus reduce or prevent cavitation in the outlet and second impellor inside the housing. This concern is only relevant if the pressure at the site of exit is low, as it is intended to be in the applicant's design. The absence of a feature to prevent backflow in the prior art devices, where no plug type feature is listed, supports the novelty of the applicant's claim and that it is not obvious or common practice to place a part of that type in the outlet of prior art designs.

In **AUSTIN**

15. Column 5, Claim 5, line 6 the author describes increasing thrust to provide "Greater propulsive effort " This increased propulsive effort would be achieved by increasing the velocity of the water through the nozzle and this would increase the pressure difference. (The greater propulsive effort of increased rotational speed of the second impellor is being achieved in this design by increasing the pressure through velocity of the same mass of water that is still relatively small). The mass of water through the system will not have increased as greatly as the pressure difference has, so the increased pressure difference will produce a larger pressure change and therefore more thrust.

16. IN Column 5, Claim 6, lines 9-11 the author describes an "open ended duct...one stage of which is of larger diameter than any succeeding stage." This feature generally explains that the diameter of the outside edges of the duct system is decreasing as the water progresses through the design. This is not a high mass-low pressure style of layout. This is not the set up of the ducting for the applicant's design.

in **BROWN**

17. THE inventor says in Column 4, Claim 5, lines 39-40 "and an outer surface which increases in diameter from said forward end and then decreases in diameter toward said pointed rearward end." This "pointed rearward end" feature generally explains that the diameter of the outside edges of the duct system is decreasing as the water progresses through the design. This is what someone practiced in the art would expect for a high pressure-low mass set up. This is not the case with the applicant's design.

in **BLANCHARD**

18. Column 6 Claim 10 line 44 a "tail cone" is referred to (Part #66 of Fig. 2) that is shown as tapering from larger diameter in the upstream flow location to smaller diameter as the downstream flow direction continues, and finally no diameter as the cone ends. This feature in its location and position shown would be typical of the prior art design and would be expected by someone practiced in the art to be tapered in the direction and manner

shown at that time. This is what someone practiced in the art would expect for a high pressure-low mass set up.

19. NONE of the authors above describe the limitations of mass or pressure because they are not trying to provide a large mass flow for their intended purpose with their chosen duct and impellor features. Their intentions were always low mass-high pressure, compared to what mass is possible to put through the duct, so a discussion of specific values was not considered, since the alternate approach was not considered.

20. IF the same mass throughput were required of the prior art designs, as is possible for the applicant's design, with the same drive engine power input, the architecture of the prior art would not be able to achieve the same throughput as the applicant's design. A practitioner skilled in the art could have seen this to be the case in July 13th, 2004, and since that time. The different layout suits the description "high mass – low pressure" in a way that the prior art geometry does not. The term high mass – low pressure would have been understood by someone practiced in the art at the time of invention.

21. THE acceptance of the high mass – low pressure and low mass high pressure distinctions as understandable terms to a practitioner skilled in the art on July 13th, 2004 and the adoption of geometry to accommodate the former description's working requirements being novel in 2004 are both reasonable positions to take. The distinction between the two conditions of operation might not be obvious to someone not skilled in the art and the proposed mechanisms and part geometries described in the application are inventive and symptomatic of an inventive step being taken at the time. The author, as one practiced in the art, would have described the description as understandable, given the shape and stated intended purposes of the features described in the application. The same opinion could have been arrived at on July 13th, 2004. As a result of this opinion, it would be reasonable to allow the items that are listed and rejected or objected to in the Examiner's Detailed Action Response, specifically claims 1-22 to be reconsidered with regard to their acceptability and patentability.

Sworn in Auckland, New Zealand.

Date: 14th May 2008

Signature: Mark A. Hildsley

SWORN at Auckland this 14th)

day of May 2008) ....

before me:)

A Solicitor of the High Court of New Zealand

Joanna Caen
Solicitor
Auckland